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New distribution records for *Euspondylus excelsum* Chávez, Catenazzi & Venegas, 2017 (Reptilia, Gymnophthalmidae, Cercosaurinae) in Peru

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Abstract

Euspondylus excelsum was described from 8 specimens from the Region Huánuco in central Peru. We obtained an adult female from the Region Junín and a subadult male (photo vouchers only) from the Region Madre de Dios. Our new records of *E. excelsum* extend the range of this species by 592 km to the south and increase the previously known elevational range from 1023–1159 m a.s.l. to 550–1550 m a.s.l. The adult female is the largest known specimen extending the maximum SVL to 90.1 mm. Our findings indicate that *E. excelsum* is relatively widely distributed in the montane forests and foothills of the eastern Andes. Its arboreal mode of life is probably one reason for its rarity and limited records during traditional field surveys.

Key words

Arboreality, eastern Andes, gymnophthalmid lizards, montane forests, range extension, Peru.

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Introduction

Herpetological surveys of the Pui Pui Protected Forest (PPPF hereafter) and its surroundings conducted by some of us between 2012 and 2014 resulted in the discovery of 6 new species of amphibians (Lehr and Moravec 2017, Lehr and von May 2017, Lehr et al. 2017a, b) and 1 new genus of reptiles (Moravec et al. 2018). In 2013 we found 1 specimen of an arboreal lizard that appeared to be a new species of Gymnophthalmidae, but we were uncertain of its generic affiliation. Subsequent expeditions unfortunately did not lead to the discovery of further specimens. The work on an extensive phylogeny of Gymnopthalmidae by Moravec et al. (2018), including tissues of our specimen from PPPF, revealed that our lizard specimen is *Euspondylus excelsum* Chávez, Catenazzi & Venegas 2017.

Herein, we provide new data on the geographic distribution and morphology of *Euspondylus excelsum*.

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Methods

Fieldwork was conducted in upper montane forests in the surroundings of the PPPF (Region Junín) in 2013 between June 10 and 17 by EL, JM, JCC, and RvM. Fieldwork at Mascoitania (Region Madre de Dios) was conducted by AW and JV in 2013 throughout the year. The collected specimen was preserved in 96% ethanol and stored in 70% ethanol.

Terminology of the morphological characters follows mostly Oftedal (1974), Chávez et al. (2017), and Sánchez-Pacheco et al. (2017). Sex and maturity of specimens were identified through sexual dimorphic characters (femoral pores, size, and coloration). According to Chávez et al. (2017), adult males can be distinguished from adult females by their higher number of femoral pores (10–12 vs 4–6 in females). The following metric characters were taken using a digital caliper and dissecting microscope: snout–vent length (SVL)—distance from the snout tip to cloaca; head length (HL)—distance from the snout tip to the angle of jaw; head width (HW)—greatest width of the head; tail length (TL)—distance from cloaca to the tail tip, if original. All examined characters were taken to the nearest 0.1 mm.

Meristic and qualitative pholidotic characters were counted and evaluated as follows: number of supralabials—from the rostral to the mouth corner, last labial defined by its considerably larger size compared with the posteriorly adjacent shields; postparietal shields—number of shields in contact with posterior margin of parietal and interparietal shields; genials—number of pairs of genial shields; lower palpebral disc—number of large sections forming the semitransparent window; gulars—number of gular scales in longitudinal medial row (including the scale of collar); nuchal scales—number of transverse rows of nuchal scales; dorsal scales—number of transverse rows of dorsal scales from the nuchal scale to the level of the rear edge of the hindlimb; ventral scales—number of transverse rows of ventral scales; longitudinal rows of ventral scales—number of rows at midbody; lateral scales—number of considerably smaller lateral scales lying between larger dorsal and ventral scales at midbody; scales around midbody; anal plates—number of large plates in the anterior and posterior row of anal scales; number of lamellae under Finger IV—number of single and divided lamellae (left/right, lamella divided in segments counted as one individual lamella); number of lamellae under Toe IV—number of single and divided lamellae (left/right, lamella divided in segments counted as one individual lamella); number of femoral pores (left/right).

Coloration in life description is based on photos and field notes. Codes of collections are: AMNH = American Museum of Natural History (New York), FMNH = Field Museum of Natural History (Chicago), MUSM = Museo de Historia Natural Universidad Nacional Mayor de San Marcos (Lima, Peru), NMP6V = National Museum Prague (Prague, Czech Republic). Maps were done with ArcGIS 10.0 (ESRI 2011).

Results

Euspondylus excelsum Chávez, Catenazzi & Venegas, 2017

Figures 3–5

New records. Peru: Region Junín. Coffee plantation on the trail leading to the PPPF (11°05′48.52″ S, 075° 12′50.9″ W, 1550 m a.s.l.), on 11 June 2013 at 11:30 AM by JCC, EL, JM, RvM; Region Madre de Dios. Regenerating foothill forest at Mascoitania (12°48′29.37″ S, 071°23′49.43″ W, 550 m a.s.l.), on 21 February 2013 at 10:25 AM by AW and JV.

Both specimens are the first records for the regions Junín and Madre de Dios, extending the species distribution by 592 km to the south and extending the elevational distribution from 1023–1159 m a.s.l. (Chávez et al. 2017) to 550–1550 m a.s.l. (Fig. 1).

The single voucher from the Region Junín, an adult female, is deposited in the Museo de Historia Natural Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM), photo vouchers (Figs 4, 5D–F) are available for the single subadult male from the Region Madre de Dios which escaped after being measured and photographed.

Identification. The adult female (MUSM 31949) from the Region Junín clusters genetically with the specimens of the type series of *Euspondylus excelsum* (Moravec et al. 2018: figs S1–S3) and its general morphology and coloration fall within the variation as described for the species. The specimens from the regions Junín and Madre de Dios share a long snout, fusion of first supraocular with first superciliar (Fig 5A, D), ventral coloration creamish white to yellow with contrasting black spots (Figs 3C, 4C, D), and similar pholidotic characters (see Table 1).

The coloration of the adult female (MUSM 31949, Figs 3, 5A–C) in life: head, body, limbs, and tail pale reddish brown dorsally (regenerated tail portion grey) (Fig. 5A); an interrupted yellowish-brown dorsolateral stripe on each side of body running from the posterior corner of eye to tail (except for regenerated tail which is grey) (Fig. 3B); dorsolateral stripe bordered ventrally by dark brown lateral stripe running from the nostril across temporal area to the pelvic region; ventrolateral parts of flanks whitish brown; axillar region pale grey (Fig. 3D); a large yellowish-brown spot on inner part of each shank (Fig. 3D); throat creamy white with faded pale grey spots (Fig. 5C); anterior belly creamy white; posterior part of belly, cloacal area, ventral surfaces of front limbs, hind limbs, and anteriormost ventral part of tail pale yellow with contrasting black spots, regenerated tail yellowish cream (Fig. 3C); iris reddish brown to orange (Fig. 5A).

The coloration of the subadult male (Figs 4, 5D–F) in life: head, body, limbs, and tail light grayish brown dorsally (Figs 4A, 5D, E); body dorsally with scattered irregular large black spots (Fig. 4A); rostral, nasal, supralabial, and infralabial shields with irregular black

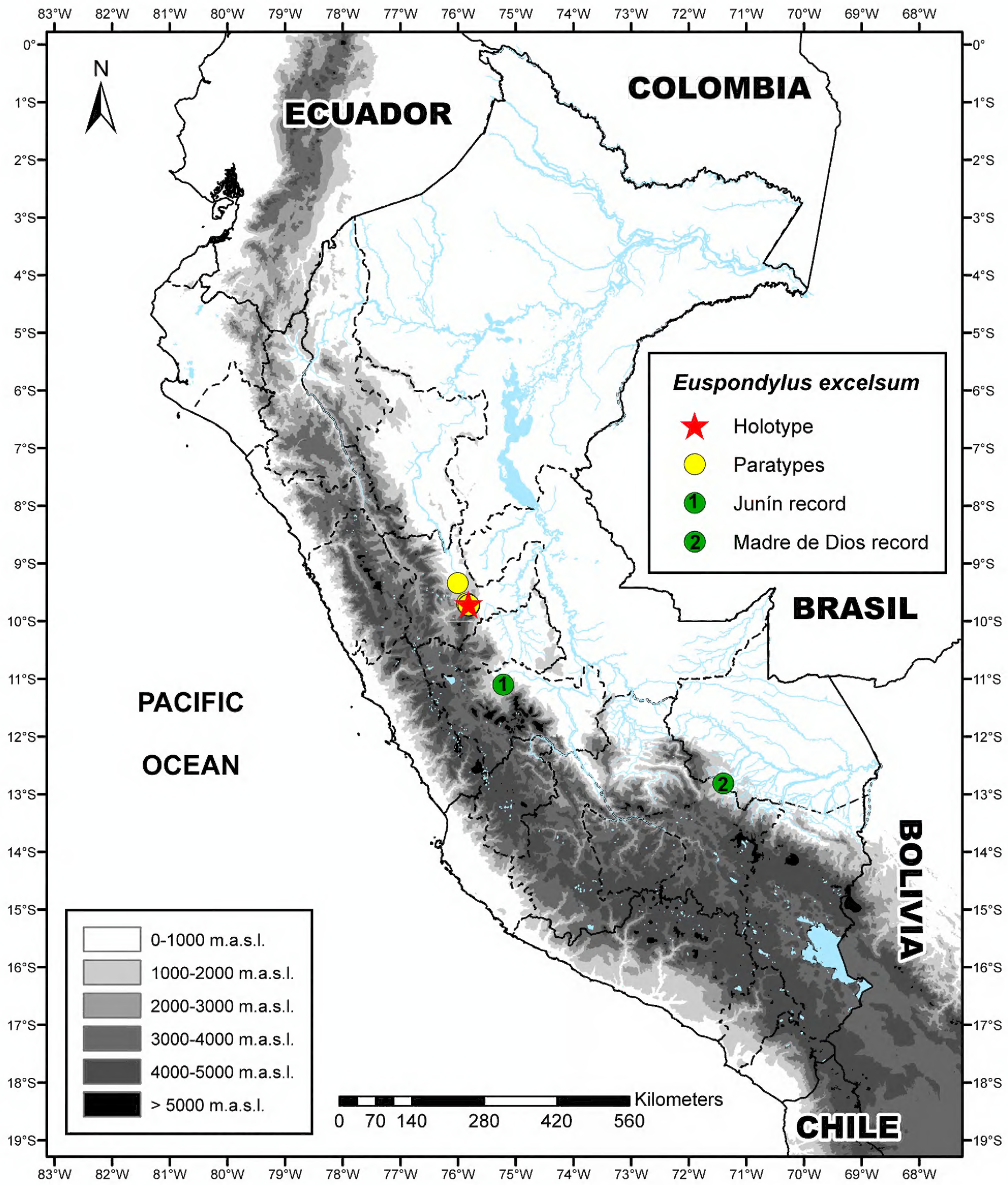

Figure 1. Map of Peru with distribution records of *Euspondylus excelsum*. The type locality is indicated by a red star and yellow circles indicate paratypes. Coordinates for type material taken from Chávez et al. (2017). Green circle number 1 indicates first record from Region Junín (11°05′48.52″ S, 075°12′50.9″ W, 1550 m) for an adult female (MUSM 31949, Figs 3, 5A–C), green circle number 2 indicates first record from Region Madre de Dios (12°48′29.37″ S, 071°23′49.43″ W, 550 m) for a subadult male (Figs 4, 5D–F) and southernmost record. The southernmost record extends the species distribution by 592 km (in a straight line). Map by JCC.

markings (Fig. 5D); an inconspicuous interrupted light gray dorsolateral stripe on each side of body running from posterior corner of eye (barely visible in temporal area) intermixed with irregular black spots, black spots becoming diffuse caudally (Fig. 4B); dorsolateral stripe bordered ventrally by discontinuous orange lateral stripe running from posterior edge of tympanum to the tail (Fig. 5A, B); axillar region and ventrolateral parts of flanks of the same color as the dorsum; throat yellowish white, belly whitish yellow to yellow; tail yellow ventrally; throat, belly, cloacal area, ventral surfaces of limbs and ventrolateral parts of tail with contrasting black spots (Fig. 5C, D); iris reddish brown with an orange tint (Fig. 5D).

Figure 2. Collecting sites and habitats of *Euspondylus excelsum* from regions Junín (**A, C**) and Madre de Dios (**B, D**). A coffee plantation in a secondary forest (A) where the adult female was found on the ground under wood (**C**) at 1550 m a.s.l. The subadult male was found in a primary forest (**B**) on the ground inside a pitfall trap (**D**) at 550 m a.s.l. Photos by EL (A, C) and AW (B, D).

Table 1. Measurements (in mm) and pholidotic characters of *Euspondylus excelsum*. A dash indicates that data are not available; a diagonal bar separates counts from left and right body side. For abbreviations see materials and methods.

Characters	*Euspondylus excelsum*	
	MUSM 31949	**Photo voucher (Figs 4, 5D–F)**
Sex	Female	Subadult male
SVL	90.1	48.1
TL	91.8 (regenerated)	53 (regenerated)
HL	19.2	—
HW	13.5	—
Supralabials	6/6	6/6
Postparietals	4	5
Genials	4 (3 in contact)	4 (3 in contact)
Lower palpebral disc	3/4	—
Gulars	16 (including collar)	17 (including collar)
Scales around midbody	45	43
Nuchal scales	1	1
Dorsal scales	36	34
Lateral scales	9/9	–/9
Ventral scales	23	23
Longitudinal rows of ventral scales	10	10
Anal plates	7	6
Lamellae under 4th finger	19/19	—
Lamellae under 4th toe	24/24	—
Femoral pores	3/3	6/6
Mass [g]	—	2.7

Distribution, natural history and conservation. *Euspondylus excelsum* is known from elevations of 550–1550 m a.s.l. in primary and secondary humid montane forests from the Regions Huánuco in central Peru to Madre de Dios in southern Peru.

The adult female (Figs 3, 5A–C) from the Region Junín was found on the ground hiding under wood panels in a coffee plantation at 11:30 AM. Another specimen hiding under the same wood panel escaped running up a tree (Fig. 2A: right tree) into a tree hole. Reptiles in sympatry include *Stenocercus fimbriatus* Avila-Pires, 1995 (NMP6V 75083) and *Micrurus annellatus* Peters, 1871 (MUSM 31967).

The subadult male from the Region Madre de Dios was found inside the bucket of a pitfall trap array in an area of regenerating foothill forest at 10:25 AM but escaped after it was measured and photographed. Gymnophthalmids in sympatry include *Alopoglossus angulatus* (Linnaeus, 1758), *Bachia dorbignyi* (Duméril & Bibron, 1839), *Cercosaura argulus* Peters, 1862, *C. bassleri* Ruibal, 1952, *Potamites ecpleopus* (Cope, 1875), and *P. erythrocularis* Chávez & Catenazzi, 2014.

Considering the relatively large area of its geographic distribution, we do not consider *E. excelsum* to be endangered. However, additional field studies need to be conducted to learn more about population densities.

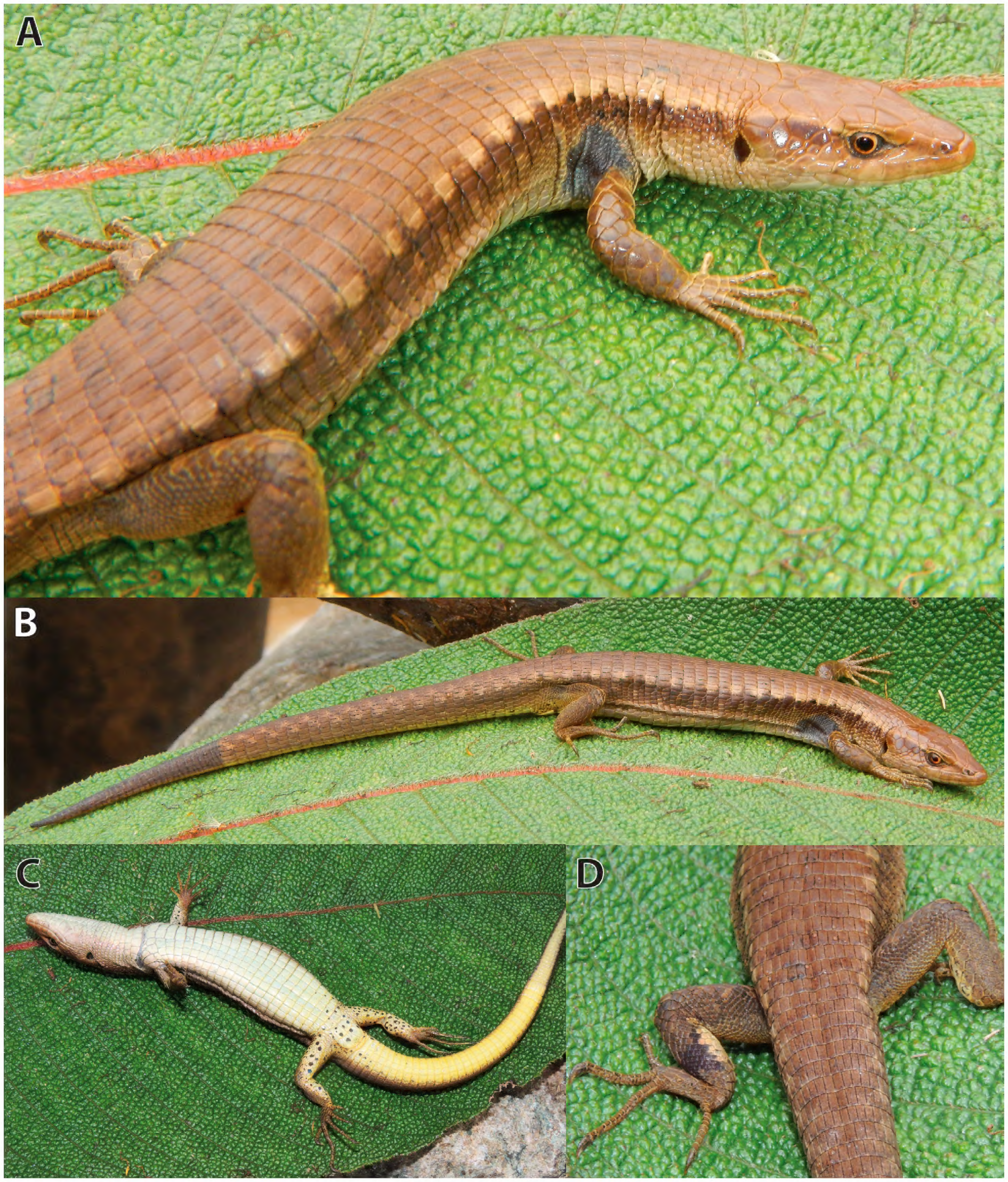

Figure 3. Adult female *Euspondylus excelsum* (MUSM 31949, SVL = 90.1 mm) in dorsolateral (**A**), lateral (**B**), ventral (**C**), and posterior dorsal (**D**) views. Photos by EL (A, B) and JM (C, D).

Discussion

Despite its large distribution, few specimens of *Euspondylus excelsum* have been recorded: 8 from Region Huánuco from 8 localities, 1 adult female from Region Junín, and 1 subadult male (photo vouchers) from Region Madre de Dios (Fig. 1). Our findings indicate that *E. excelsum* represents a widely distributed but overlooked species with a gap of 458 km between the locality close to the PPPF in the Region Junín and Mascoitania in proximity to Manu National Park in the Region Madre de Dios (Fig. 1).

The species has been observed in the canopy but also has been found on the ground hiding under wood or swimming in water (Chávez et al. 2017). However, while some individuals were previously observed on trunks at 1.5 m above the leaf litter, the height of the canopy vegetation used by this species has not been specified (Chávez et al. 2017). The arboreal mode of life of *E. excelsum* is probably one reason for its rarity and limited

Figure 4. Subadult male *Euspondylus excelsum* (not collected, SVL = 48.1 mm) in dorsolateral (**A**), lateral (**B**, rostrum incompletely photographed), ventral (**C**), and posterior ventral (**D**) views. Photos by AW.

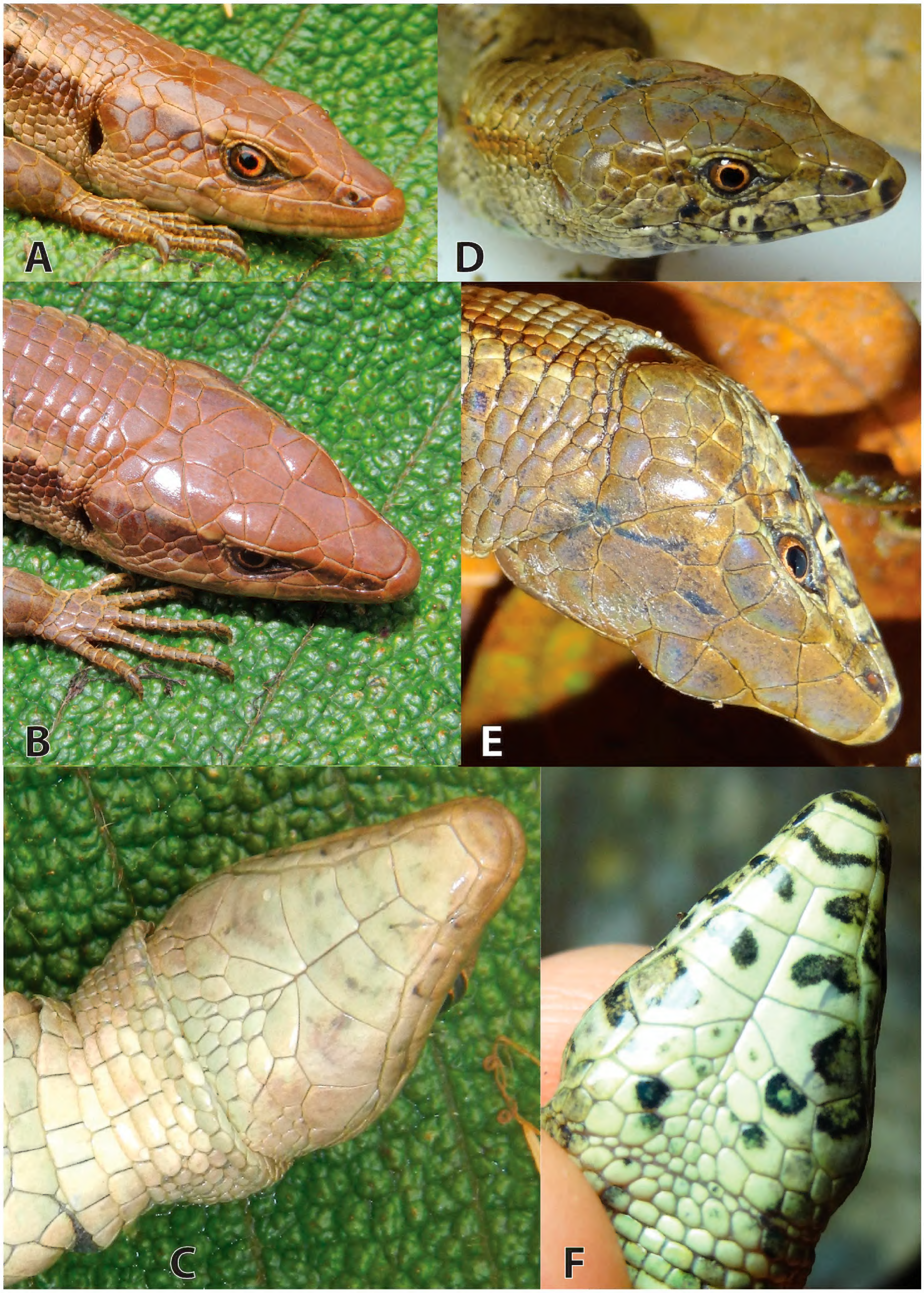

Figure 5. Comparisons of head scutelation of female (MUSM 31949, **A–C**, head length = 9.2 mm) and subadult male (**D–F**, head length not available) from Junín and Madre de Dios, respectively. Note the fusion of the first supraocular with the first superciliar (**A, D**) which was noted as an important character for *Euspondylus excelsum* by Chávez et al. (2017). Photos by EL (A, C), JM (B), and AW (D–F).

records during traditional field surveys. After 3½ years of intense herpetological surveys at Mascoitania by AW and JV, including pitfall trapping, leaf litter plots, diurnal searches and nocturnal visual encounter surveys, only 1 individual of *E. excelsum* was recorded. Our 2 specimens were found on the ground (under wood panels, in a pitfall trap). Carefully looking under wood panels (exposed to the sun), using pitfall traps, visually observing tree trunks and looking into tree holes seem to be successful capture methods for *E. excelsum*. For additional methods we refer to Das (2012) and Henderson et al. (2016) who provide an overview of methods and challenges to capture arboreal lizards.

Our adult female (3/3 femoral pores) from Junín increases the maximum known SVL for females from 81.8 mm (Chávez et al. 2017) to 90.1 mm. Both of our specimens add to the variation of pholidosis (see Table 1) and coloration (see Figs 3–5). Chávez et al. (2017) noted variation in coloration for males and females with males having red lateral stripes with black and white spots and dense contrasting black spots ventrally, whereas females lack such lateral stripes and have fewer black spots ventrally which are restricted ventrolaterally on the tail. The adult female has very few black spots ventrally restricted to hind and front limbs (Fig. 3C), posterior portion of belly, cloacal region, base of tale (Fig. 4C), and black spots fade to pale grey spots on the throat (Fig. 5C). The subadult male (6/6 femoral pores) has an orange stripe laterally, and black spots ventrally on body and ventrolaterally on tail, similar to coloration pattern described for females by Chávez et al. (2017). The species demonstrates a coloration polymorphism and likely ontogenetic coloration changes.

Chávez et al. (2017) reported 2 forms of *Euspondylus* resembling *E. excelsum*, which were originally assigned to *E. maculatus*. The first form (*Euspondylus* sp. 1, FMNH 40584, 45474) was collected in Chanchamayo valley, Region Junín, central Peru and the second form (*Euspondylus* sp. 2, AMNH 1704) originates from Mina Inca, Santo Domingo, Region Puno, southern Peru. Morphological differences between these 2 forms and *E. excelsum* given by Chávez et al. (2017) seem to be very weak. *Euspondylus* sp. 1 differs in number of supralabials (5 vs 6 in *E. excelsum*), number of superciliars (6 vs 4–5 in *E. excelsum*), number of preanal scales (5 vs 7–8 in *E. excelsum*), and number of postparietals (exact data not given). *Euspondylus* sp. 2 has lower number of supralabials (5 vs 6 in *E. excelsum*) and differs in "longitude" of temporals (exact data not given). According to Chávez et al. (2017), it should also disagree in number of pairs of genials being in contact. However, the published scale counts (Chávez et al. 2017: table 1) are nearly identical (2 pairs vs 2–3 pairs in *E. excelsum*). Our additional 2 specimens of *E. excelsum* (Table 1) indicate that the species reveals a higher morphological variation than originally recognized for the type material. In this light, the noticed morphological differences of *Euspondylus* sp. 1 and *Euspondylus* sp. 2 are not sufficient for distinguishing these 2 taxa from *E. excelsum*. Therefore, genetic comparison and fieldwork is required to solve the taxonomic status of *Euspondylus* sp. 1 and *Euspondylus* sp. 2.

The PPPF is located in the Selva Central of Peru and covers 60,000 hectares (30% montane forest, 70% puna habitats) between 1700 and 4500 m a.s.l. (SERNANP 2010). We surveyed the herpetofauna of the PPPF and its close surroundings in upper montane forests in 2012, 2013, and 2014 in order to document the amphibian and reptile species richness and to evaluate their conservation status and despite our efforts only 2 specimens of *E. excelsum* were recorded of which 1 could be captured. We showed photographs of *E. excelsum* to various locals in the surroundings of the PPPF in subsequent expeditions but they were unaware of this species.

The locality Mascoitania in the Region Madre de Dios holds a research station and lodge, the Manu Learning Centre (12°47′21.85″ S, 071°23′28.06″ W, 460 m a.s.l.), situated on the eastern Andean foothills, along the Alto Madre de Dios River, in the buffer area of Manu Biosphere Reserve, situated directly between Manu National Park to the west and the Amarakaeri Communal Reserve to the east (Fig. 1). It is a private reserve owned by The Crees Foundation (http://www.crees-manu.org), which hosts tourism, research and volunteer activities. It contains areas of primary terra firma, regenerating logged, regenerating clear-felled, and bamboo forest with an altitudinal gradient of 450–750 m a.s.l. At the Manu Learning Center 80 confirmed species of reptiles have been recorded to date (AW and JV unpubl. data), including the 7 above mentioned gymnophthalmids.

The recent discovery of arboreal lizards (e.g., *Selvasaura*, Unnamed Clade 4 in Moravec et al. 2018: 117, fig. 3) in the eastern montane forests demonstrates that this region harbors a high diversity of arboreal gymnophthalmids.

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Authors' Contributions

All authors conducted fieldwork; EL and JM wrote the manuscript; AW and JV collected a specimen, contributed data, photo vouchers, and text portions; JCC collected a specimen and designed the map, RvM provided to the text.

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